U. S. FOREST SERVICE

RESEARCH NOTE LS-21

KE STATES FOREST EXPERIMENT STATION • U. S. DEPARTMENT OF AGRICULTURE

# Growth Response of Some Shelterbelt Species Following Sod Removal — Preliminary Results

The establishment and growth of shelterbelt trees are seriously hindered by the competitive growth of grasses and other weeds throughout much of the Northern Great Plains. In the semi-arid parts of the region where droughts are frequent, trees often cannot compete successfully against the better adapted grasses for sparse soil moisture. The results are poor survival and stunted growth. For the best survival and growth, authorities recommend cultivation of shelterbelts, if possible, until tree crown closure shades out the undergrowth.[1] Unfortunately, this practice has not been followed in many tree plantings. A 1954 survey showed a large percentage of windbreaks, especially in the Dakotas, were sod- and weedbound. Less than 1 percent of all sample windbreaks were still being cultivated.[2]

[1] *George, E. J. Cultural practices for growing shelterbelt trees on the Northern Great Plains, U. S. Dept. Agr. Tech. Bul. 1138, 33 pp. 1956.*

[2] *Read, Ralph A. The Great Plains shelterbelt in 1954. Great Plains Agr. Council Pub. 16, Bul. 411, 125 pp. 1958.*

The question arises: Can the various species of a sod-bound planting be stimulated to increased growth by renewed cultivation, and if so, what degree of sod removal is actually necessary to obtain a satisfactory response?

In an attempt to answer this question, two shelterbelts were selected in 1960 for renewed cultivation in north central North Dakota, one near the town of Souris and the other near Westhope. The one near Souris is a 1949 farmstead planting of two rows of caragana, one of boxelder, and one of green ash. It had been cultivated for about the first 5 years, after which brome grass and other weeds invaded the site and created a dense ground cover (fig. 1). The one near Westhope is a field shelterbelt that was planted in 1946. It consists of one row each of caragana, Rocky Mountain juniper, American elm, boxelder, and a mixed row of caragana and chokecherry. It had reportedly been cultivated no more than 2 or 3 years after planting and was densely sod-bound, primarily with brome grass. Both sites have a medium to heavy-

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FIGURE 1. — Sod-bound shelterbelt partially renovated by sod removal (moderate treatment) using a 4-foot-wide rototiller. Grass is *Bromus inermis*, height 3 to 4 feet. Souris, No. Dak.

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textured Barnes loam soil, level topography, and water tables well below 10 feet.

Cultivation treatments were designed as follows: complete — sod removal between tree rows and between the trees in the row; moderate — sod removal between tree rows only; light — sod removal between tree rows but about half the width of the moderate treatment; check — no sod removal. About 20 trees of each species were included in each treatment. Treatments were arranged in a randomized block design with two replications in each belt.

Cultivation was initiated in July 1960. Complete, moderate, and light treatments were mowed, cultivated with a rototiller, and then disked. Mowing was necessary to prevent clogging of the tiller blades. All implements were tractor-drawn, except a small gasoline-powered roto-tiller used for cultivation around trees in the complete treatment. The check was left undisturbed.

During subsequent cultivations in 1961 and 1962 the work was accomplished with a tractor-drawn field cultivator and tandem disk. The distance between rows in both belts was approximately 10 feet, which was sufficient to allow passage of tractor and implements. The number of cultivation operations necessary during a season varied, of course, with weather conditions. During dry years such as 1960 and 1961, with precipitation totals of 11.74 and 8.24 inches respectively, two or three operations were sufficient. With more favorable temperatures and precipitation, additional cultivations might be necessary.

Height, diameter, and crown spread were the three measurements of treatment effects. Height and crown spread were measured to

TABLE 1. — *Two-year growth averages after cultivation — Westhope area planting*

| Species (*Row*) | Height (*Feet*) | Diameter (*Inches*) | Crown spread (*Feet*) |
|---|---|---|---|
| *Complete Cultivation* | | | |
| Caragana | 1.15 | [1]— | — |
| Rocky Mtn. juniper | 1.53 | 0.44 | 1.15 |
| American elm* | 1.89 | 0.44 | 0.70 |
| Boxelder | 1.44 | 0.26 | 0.56 |
| Caragana[2] | 0.88 | — | — |
| *Moderate Cultivation* | | | |
| Caragana | 0.50 | — | — |
| Rocky Mtn. juniper | 1.56 | 0.44 | 1.16 |
| American elm* | 1.86 | 0.49 | 1.03 |
| Boxelder | 1.36 | 0.29 | 0.66 |
| Caragana[2] | 0.74 | — | — |
| *Light Cultivation* | | | |
| Caragana | 0.89 | — | — |
| Rocky Mtn. juniper | 1.37 | 0.41 | 1.09 |
| American elm* | 1.47 | 0.37 | 0.02 |
| Boxelder | 0.85 | 0.29 | --0.07 |
| Caragana[2] | 0.86 | — | — |
| *Check* | | | |
| Caragana | 0.51 | — | — |
| Rocky Mtn. juniper | 1.34 | 0.33 | 0.99 |
| American elm | 0.60 | 0.22 | --0.52 |
| Boxelder | 0.68 | 0.22 | --0.06 |
| Caragana[2] | 0.57 | — | — |

* *Cultivation treatments significantly different (5-percent level) from check.*

[1] *A dash (—) means no measurements taken.*

[2] *This row was a mixture of caragana and chokecherry; only the caragana was measured.*

TABLE 2. — *Two-year growth averages after cultivation — Souris area planting*[1]

| Species (*Row*) | Height (*Feet*) | Diameter (*Inches*) | Crown spread (*Feet*) |
|---|---|---|---|
| *Complete Cultivation* | | | |
| Caragana | .73 | [2]— | — |
| Boxelder | 1.64 | 0.35 | 1.34 |
| Green ash | 2.02 | 0.56 | 1.74 |
| Caragana | 1.53 | — | — |
| *Moderate Cultivation* | | | |
| Caragana | 0.63 | — | — |
| Boxelder | 1.97 | 0.44 | 1.68 |
| Green ash | 2.11 | 0.59 | 2.09 |
| Caragana | 1.76 | — | — |
| *Light Cultivation* | | | |
| Caragana | 0.59 | — | — |
| Boxelder | 1.74 | 0.36 | 1.06 |
| Green ash | 1.70 | 0.54 | 0.93 |
| Caragana | 1.37 | — | — |
| *Check* | | | |
| Caragana | 0.25 | — | — |
| Boxelder | 0.03 | 0.15 | -0.38 |
| Green ash | 0.13 | 0.16 | 0.05 |
| Caragana | 0.54 | — | — |

[1] *All cultivation treatments significantly different (5-percent level) from check.*

[2] *A dash (—) means no measurements taken.*

the nearest one-tenth of a foot and diameters were measured to the nearest one-tenth of an inch at a height of 3 feet (to include as many of the small trees as possible). Average height, diameter, and crown spread increments were calculated for each year after the start of cultivation.

After one year's cultivation, growth increments of some of the species showed slight gains for the cultivation treatments over the control. After 2 years the beneficial effects of the cultivation were much more pronounced (tables 1 and 2).

All species have benefited in height growth from all degrees of cultivation. This is particularly true of the faster growing American elm, boxelder, and green ash. Comparative gains between the complete and moderate cultivations are not as clearly defined, however, and further trial and study will be necessary to determine whether complete sod removal is necessary or even advisable. Growth, measured in terms of diameter and crown spread, is also generally better in the cultivations than in the check. Growth losses in the check are the result of widespread dieback, resulting probably from drought conditions of the 2 previous years coupled with the effects of the competing grasses.

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